

WHAT IS CLAIMED IS:

1. A device comprising:
 - a host having defined therein at least one substantially tubular, hollow passageway through said host, wherein said passageway has an average diameter from 0.1 micron to 1000 microns; and
 - a plurality of hollow interconnects, wherein said interconnects are formed when a first portion of said passageway contacts a second portion of said passageway or a second passageway, and wherein said interconnects connect the first portion of said passageway to at least the second portion of said passageway or to the second passageway thereby establishing fluid communication.
2. The device of claim 1, wherein the longest cross-sectional dimension of said interconnect between the first and the second portion of said passageway is less than 2.5 times the average diameter of said passageway.
3. The device of claim 1, wherein the longest cross-sectional dimension of said interconnect between the first portion of said passageway and the second passageway is less than 2.5 times the average diameter of said passageway.
4. The device of claim 1, wherein said passageway has an average diameter from 10 microns to 500 microns.
5. The device of claim 1, wherein said passageway has an average diameter from 50 microns to 250 microns.
6. The device of claim 1, wherein said host comprises a ceramic.

7. The device of claim 1, wherein said host comprises a metal.
8. The device of claim 1, wherein said host is selected from the group consisting of plastics, polyesters, polyamides, polyethers, epoxies, latexes, poly(dimethyl siloxane), their derivatives, and mixtures thereof.
9. The device of claim 1, wherein said host is substantially homogeneous throughout.
10. The device of claim 1, wherein said host comprises a plastic.
11. The device of claim 10, wherein said plastic is an epoxy.
12. The device of claim 10, wherein said plastic comprises non-plastic particles.
13. The device of claim 12, wherein said particles comprise a metal.
14. The device of claim 12, wherein said particles comprise a ceramic or a glass.
15. The device of claim 12, wherein said particles comprise a semiconductor.
16. The device of claim 1, wherein said host comprises microfibers.
17. The device of claim 16, wherein said fibers are selected from the group consisting of nylon fibers, glass fibers, carbon fibers, natural fibers, aramid fibers, and mixtures thereof.

18. The device of claim 1, further comprising an inlet port and an outlet port, wherein said ports are in fluid communication with the at least one passageway, such that when a fluid is introduced to the inlet port, the fluid may flow through the at least one passageway and the interconnects and exit the host through the outlet port.
19. The device of claim 18, wherein said fluid is selected from the group consisting of liquids, gases, and combinations thereof.
20. The device of claim 1, wherein said passageway comprises a first portion extending along a first plane in the x and y dimensions, a second portion extending perpendicular to the first plane in a z dimension, and a third portion extending in a substantially planar fashion in a second x and y dimension plane that is substantially parallel to the first plane.
21. The device of claim 20, wherein said passageway is longer in said planar dimension than in said perpendicular dimension.
22. The device of claim 20, wherein said interconnects are formed in said perpendicular dimension.
23. The device of claim 1, wherein said interconnects only form in a dimension perpendicular to said passageway.
24. The device of claim 1, wherein said passageway has a cross-sectional periphery comprising at most one flattened portion, and the remaining non-flattened portion of the periphery is curved in shape.
25. The device of claim 1, wherein said passageway is formed by removing a fugitive material from an interior of said host.

26. The device of claim 1, wherein said passageway and said interconnects are formed by removing a fugitive material from an interior of said host.
27. The device of claim 1, wherein said passageway is not formed by joining two or more open troughs.
28. The device of claim 1, wherein a portion of said passageway, a portion of said interconnects, or a portion of said passageway and a portion of said interconnects is sealed with a cured resin.
29. The device of claim 28, wherein said host comprises a hollow, vertically-oriented, square-spiral mixing tower.
30. The device of claim 1, wherein at least a portion of said passageway is lined with a non-fugitive material.
31. The device of claim 30, wherein said non-fugitive material comprises a solidified colloidal ink.
32. The device of claim 30, wherein said non-fugitive material comprises a solidified pseudoplastic slurry.
33. The device of claim 1, wherein at least a portion of said passageway is partially filled with a solidified colloidal ink.
34. The device of claim 1, wherein at least a portion of said passageway is filled with a solidified pseudoplastic slurry.

35. The device of claim 1, where the host is a coating on the surface of the device.
36. The device of claim 1, wherein the device is a biomedical microfluidic device.
37. The device of claim 1, wherein said device is an aircraft structure.
38. The device of claim 1, wherein said device is a space vehicle or a satellite.
39. The device of claim 1, wherein said device is a surface or a subsurface water craft.
40. The device of claim 1, wherein said device is a bridge or a building.
41. A method of closing an opening in a device comprising:
filling at least a portion of said passageway and said interconnects in the device of claim 1 with a liquid material;
opening said passageway in at least one location, wherein said liquid material flows from said opening and substantially closes said opening.
42. The method of claim 41, wherein said liquid material cures after flowing from said opening.
43. A method of mixing a fluid, comprising
passing a liquid through at least a portion of said passageway and said interconnects in the device of claim 1.

44. The method of claim 43, wherein said liquid comprises a dissolved or suspended solid.
45. The method of claim 44, wherein said solid is selected from the group consisting of biomolecules, DNA, RNA, proteins, organic materials, inorganic materials, and combinations thereof.
46. A method of directing at least one fluid to at least one portion of the device of claim 1, comprising:
selectively sealing a portion of said passageway and said interconnects in the device of claim 1;
introducing at least one fluid to at least one unsealed portion of said passageway and said interconnects.
47. The method of claim 46, wherein said host further comprises electrodes that provide an electric potential to direct the at least one fluid.
48. A host comprising a hollow passageway defined in the host, the passageway comprising a first substantially tubular section aligned in a first plane in fluid communication with a second substantially tubular section aligned in a second plane, wherein the substantially tubular sections have a diameter of from 0.1 micron to 1000 microns and the first plane and the second plane are substantially parallel.
49. The host of claim 48, further comprising a plurality of interconnects that provide said fluid communication between said first and second substantially tubular sections.
50. The host of claim 48, wherein the passageway further comprises a third substantially tubular section aligned in a third plane parallel to the

second plane and in fluid communication with the second section.

51. The host of claim 50, further comprising a plurality of interconnects that provide said fluid communication between said first, second, and third substantially tubular sections.

52. A host comprising a plurality of hollow passageways defined therein, said passageways having a diameter of from 0.1 micron to 1000 microns and having portions that are substantially tubular, wherein said passageways are aligned in at least one common plane and each of said passageways intersect with at least one other passageway in the said common plane.

53. The host of claim 52, wherein the substantially tubular portions of the passageways comprise at least half the cross-sectional periphery of the passageways.

54. In a microstructure comprising a host material having a plurality of passageways aligned in a plurality of layers, at least one of said passageways in one layer in fluid communication with at least one of said passageways in an adjacent layer, the improvement comprising:

said passageways are substantially tubular and have an average diameter of from 0.1 micron to 1000 microns.

55. A microstructure comprising a host having a three-dimensional grid of substantially tubular hollow passageways defined therein, where each substantially tubular hollow passageway has a diameter less than 1000 microns and is aligned in one of a series of stacked parallel planes, at least one passageway in each plane being connected to at least one passageway in an adjacent plane.

56. The microstructure of claim 55, wherein the passageways in one plane are connected by a plurality of perpendicular interconnects to the passageways in the adjacent parallel plane.
57. The microstructure of claim 55, further comprising a cured resin that partially seals said passageways and said interconnects, such that a non-sealed portion of said passageways and interconnects is in fluid communication to define a vertically-oriented, square-spiral mixing tower.
58. The microstructure of claim 55, further comprising a cured resin that partially seals said passageways and said interconnects, such that a non-sealed portion of said passageways and interconnects is in fluid communication to define a vertically-oriented, triangular-spiral mixing tower.
59. The microstructure of claim 55, further comprising a cured resin that partially seals said passageways and said interconnects, such that a non-sealed portion of said passageways and interconnects is in fluid communication to define a twisted-pipe.
60. A method of forming a microcapillary network in a host comprising:
providing a substrate;
applying a fugitive material to a surface of said substrate to form a substantially tubular filament, wherein said filament has an average diameter of from 0.1 micron to 1000 microns;
applying a host material to said substrate that encapsulates at least a portion of said filaments;
curing said host material to form a host;
removing at least a portion of said fugitive material from the host to form a network of hollow, substantially tubular passageways in said host.

61. The method of claim 60, wherein said filament has an average diameter of from 10 microns to 500 microns.
62. The method of claim 60, wherein said filament has an average diameter of from 50 microns to 250 microns.
63. The method of claim 60, wherein said filament forms a scaffold.
64. The method of claim 63, wherein said scaffold is a three-dimensional scaffold.
65. The method of claim 60, wherein said filament is first applied to said substrate, said host material is then applied to said substrate to encapsulate at least a portion of said filaments, and said host material is then cured.
66. The method of claim 60, wherein said host material is first applied to said substrate as a liquid, said filament is then applied to said substrate, and said host material is then cured.
67. The method of claim 60, wherein said substrate is selected from the group consisting of glass, plastic, metal, and combinations thereof.
68. The method of claim 60, wherein said filament is applied to said substrate by forcing said fugitive material through an orifice.
69. The method of claim 68, wherein said orifice has a diameter larger than the average diameter of the filament.

70. The method of claim 68, wherein said fugitive material self-assembles after passing through said orifice.
71. The method of claim 60, wherein said filament is deposited on said substrate by a computer controlled device comprising an orifice.
72. The method of claim 71, wherein said computer controlled device is a robotically controlled deposition machine.
73. The method of claim 60, wherein said fugitive material is heated prior to removal.
74. The method of claim 60, wherein said fugitive material is removed by vacuum.
75. The method of claim 60, wherein said fugitive material is removed as a liquid.
76. The method of claim 60, further comprising filling a portion of said passageway, a portion of said interconnects, or a portion of said passageway and a portion of said interconnects with a curable resin.
77. The method of claim 76, wherein said curable resin is photocurable.
78. The method of claim 76, wherein said curable resin is a photocurable epoxy.
79. The method of claim 76, further comprising curing at least a portion of said curable resin and substantially removing uncured curable resin.

80. A method of forming a host comprising at least one substantially tubular, hollow passageway having a first portion connected to at least a second portion by a plurality of hollow interconnects, wherein said passageway has an average diameter from 0.1 micron to 1000 microns, the method comprising removing a fugitive material from said host to form said hollow passageway and said plurality of hollow interconnects.
81. The method of claim 80, wherein said fugitive material is substantially removed as a liquid.
82. The method of claim 80, wherein said fugitive material comprises at least 80% nonvolatile components by weight.
83. The method of claim 82, wherein said fugitive material comprises organic and inorganic constituents.
84. The method of claim 82, wherein said fugitive material comprises a majority of organic constituents.
85. The method of claim 82, wherein said fugitive material comprises a viscosity modifier.
86. The method of claim 82, wherein said fugitive material comprises less than 10% by weight of a viscosity modifier.
87. The method of claim 85, wherein said viscosity modifier is selected from the group consisting of porous colloid particles, calcium complex rods, lithium hydroxystearate fibers, liquid crystals, viscoelastic micelles, oligomers, beads, microcapsules, polymer fibers, ceramic fibers, metal fibers, and mixtures thereof.

88. The method of claim 85, wherein said viscosity modifier comprises fumed silica.